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54 Load carriage for industrial trucks

57 Load carriage for industrial trucks comprising a vertically adjustable base carriage which is operated by a lifting mechanism and located on a mast of the industrial truck, as well as a push carriage accommodating a load fork which can be laterally displaced via an upper and a lower horizontal guide on the base carriage, the upper guide also being load-bearing, as well as an adjuster drive for the push carriage located on the base carriage, characterized in that the base carriage (10) and the push carriage (12) have ball tracks (58, 60) located in surfaces facing one another (54, 56) and which accommodate a number of large diameter balls, the end sections of specific length of the lower ball track (58) remain free of balls (62) when the push carriage (12) is in the neutral position.

[Diagram]

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PLEASE REPLY TO:

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<u>Load carriages for industrial trucks</u>

The invention refers to a carriage for industrial trucks according to Claim 1.

The invention refers particularly to a so-called side shift for industrial trucks which comprises a base carriage and a push carriage. The base carriage is vertically adjustable, is located on the mast of the industrial truck, and is operated by means of a lifting mechanism. The push carriage is located on the base carriage and is horizontally displaceable, in the course of which a hydraulic adjuster drive moves the push carriage relative to the base carriage. To this end an arrangement of piston cylinders is integrated into the base carriage and affect the push carriage. The load forks are suspended on the push carriage by an appropriate means.

In well known carriages the push carriage is laterally moveable by means of two horizontal slide bearings arranged at a distance from each other. An upper bearing contains a guide rod whose cross-section is circular, and the push carriage has a guide channel in which slide elements are arranged at intervals. The lower guide consists of rollers on the base carriage which interact with a running surface on the push carriage. The hydraulic cylinders for adjusting the push carriage are driven, through a directional control valve, by the hydraulic pump already provided for the lifting hydraulics in the vehicle.

Because of the stick-flip effects of the slide bearings and the low volume flows (relative to the lift hydraulics) of the lateral push function, a sensitive and jolt-free operation of the lateral thrust function is very difficult to achieve. Furthermore, with greater lifting heights, e.g. over 6 m, the hydraulic feeder hoses from the hydraulic valve to the lateral thrust cylinders are very long and the stick-slip effect is even more pronounced due to the elasticity of the hoses.

In addition, from the aspect of the degree effectiveness, the hydraulic operation of the side shift is not optimal. In today's systems, either a large portion of the volume flow provided by the pump is throttled in the valve, or the pump runs with very low rpm. In both cases the effectiveness is poor.

The object of the invention is to design a carriage with push carriage in such a way that the lateral thrust carriage can be operated with sensitivity and jolt-free. In addition, its operation must be more effective.

This objective is solved by the characteristics of Claim 1.

In the carriage according to the invention, the base carriage and the push carriage have ball tracks on surfaces facing one another which together accommodate a series of large diameter balls. The end section of the lower ball track is free of balls over a specified length when the push carriage is in the neutral position. The section that has no balls is

dimensioned in such a way that with the desired stroke of the push carriage sufficient movement of the balls to both sides is possible.

A very low surface pressure is created through balls of specific size and through the relatively great number of balls, so that it is easy to bring about the transmission of force from the load to the base carriage via the balls. The surface pressure is even so low that, according to one embodiment of the invention, the components of the ball tracks can be manufactured from weldable material. The base carriage and the push carriage can, therefore, be designed as a weldment in the usual way.

Replacing the sliders used to date with balls results in an insignificant increase in manufacturing costs compared to well known side shifts. On the one hand, the forces of the side shift are greatly reduced since the stick-slip effects do not occur. The operating force for the push carriage is thus reduced. This also results in a more sensitive operation of the push carriage while the effectiveness of the hydraulics is relatively good.

According to one embodiment of the invention, the perpendicular plane on the ball tracks is arranged at an angle to the vertical in such a way that the balls (62) effectively transmit the weight moment as well as the load moment. The weight acts in a vertical direction and the moment in a horizontal direction. The resultant force lies between these two directions, the angle of the resultant force depending on the load geometry.

According to a further embodiment of the invention, the ball tracks are incorporated into slide rails which are firmly connected to the base carriage and the push carriage. The connection can be bolted or welded, for instance.

The travel of the push carriage can be carried out in the usual way. Particularly preferred as the adjuster drive is an electric motor which is mounted on the base carriage and connected to the push carriage by means of appropriate gears. Appropriate gears could be a spindle drive, synchronous belt drive, cogwheel drive or a chain drive.

To date, the strong adjustment forces of slide bearings have prevented the use of an electric motor. If, besides the lateral thrust function, no further secondary function is

required on the load component of the fork lift, then a complicated and expensive installation of hydraulic lines on the lifting stage to the load component is unnecessary. Instead, an electric power supply line to the electric motor is required. This is much thinner and easier to install.

The invention is described in more detail in the drawings below based on one embodiment.

Fig. 1 shows and exploded view of a well known side shift.

Fig. 2 shows a side view of one part of the base carriage and push carriage assembly according to Fig. 1.

Fig. 3 shows a section through the diagram according to Fig. 2 along line 3-3.

Fig. 4 shows a side view similar to Fig. 2, but in an embodiment according to the invention.

Fig. 5 shows a section through the diagram according to Fig. 4 along line 5-5.

Fig. 1 shows a base carriage 10 and a push carriage 12. The base carriage 10 has two parallel rails 14, 16 at a distance from each other which accommodate rollers 18, 20 on the outside. The rollers are vertically moveable and located and moved in guide rails (not shown) of a mast of an industrial truck (not shown). The base carriage is adjusted vertically by means of a well known lifting mechanism in the mast in order to lift and lower a load.

The rails 14, 16 are connected on the front side by means of an appropriate upper tie-bar 22, for instance by welding. The tie-bar 22 accommodates two hydraulic cylinders whose pistons are shown at 24 and 26. On a further transverse piece 28 which is connected to the underside of the tie-bar 22 are two pivoting rollers located around a vertical axis (only one roller is shown at 30).

The push carriage 12 is designed as a frame with an upper cross strut 32 and a lower cross strut 34 as well as lateral struts 36, 38 which are bent at a right angle so that the length of the upper strut 32 is greater than that of the lower strut 34. The upper strut 32 is provided with toothing 40 to accommodate load forks (not shown). The load forks can be mounted on the push carriage 32 at various distances from each other. The load forks, which point to the left in Fig. 1, are mounted in the usual way.

A guide rod 42, whose cross-section is circular, is welded onto the tie-bar 22 on which U-shaped slide elements 44 are placed at a distance from each other. The upper cross strut 32 is placed on the arrangement of guide rod 42 and slide elements 44, as shown in Figures 2 and 3. In Fig. 2 it can be seen that the piston 24 is connected to the side strut 36. A displacement of the piston 24 in the cylinder 50 in the tie-bar 22 adjusts the push carriage 12 to one side relative to the base carriage 20. The piston 26 provides the travel to the other side. It is clear that the upper slideway, which is formed by the guide rod 42 and the slide elements 44, causes a sliding friction with an unavoidable stick-slip effect.

In the embodiment according to the invention shown in Figures 4 and 5, those parts which are the same as the parts on Figures 1 to 3 are provided with the same reference characters. In Fig. 5 it can be seen that an upper tie-bar 22a, comparable to the tie-bar 22 in Figures 1 to 3, has a guide rail 52 lying on it which is fastened to the tie-bar 22a by means of a bolted connection. The guide rail 52 has an upward-facing inclined surface 54. Fig. 5 also shows the upper cross strut 32a of the push carriage 12. It can be seen that this cross strut 32a is designed as a guide rail with a downward-facing inclined surface 56 whose gradient is the same as the inclined surface 54. Both surfaces 54, 56 incorporate ball tracks 58, 60 to accommodate balls 62. It can be seen that a total of 29 balls are accommodated which, when the push carriage 12 is in the neutral position, leave one section at the end of the ball tracks 58, 60 empty. The length of the end section of the ball track 58 which remains empty is equivalent to half the stroke of the push carriage to each side. For instance, if the empty end section is 35 mm, the side stroke of the push carriage to both sides is 70 mm.

In Fig. 1, the possible lateral strokes H+ and H– are indicated. Accordingly, the length of the empty end section of the ball track 58 is 1/2H.

The (shown) operation of the push carriage12 does not differ from the well known arrangement. Accordingly, the cylinder 50 has hydraulic connections as shown by the broken lines in Figures 2 and 4.

However, it is also possible to design the operation in such a way that the base carriage 10 accommodates an electric motor which is connected by an appropriate gear to the push carriage 12 in order to adjust it. Since the balls cause only minor friction between the parts to be adjusted in relation to each other, the initial force for the travel of the push carriage 12 is also very minor.

The lower guide for the push carriage 12 on the base carriage 10 is a conventional one. Approx. two rollers 30 can be provided according to Fig. 1 which, with a corresponding vertical opposing surface, interact with a lower cross strut 34. Here, too, the friction is rolling friction and a stick-slip effect does not occur.

Claims:

1. Load carriage for industrial trucks comprising a vertically adjustable base carriage which is operated by a lifting mechanism and located on a mast of the industrial truck, as well as a push carriage accommodating a load fork which can be laterally displaced via an upper and a lower horizontal guide on the base carriage, the upper guide also being load-bearing, as well as an adjuster drive for the push carriage located on the base carriage, characterized in that the base carriage (10) and the push carriage (12) have ball tracks (58, 60) located in surfaces facing one another (54, 56) and which accommodate a number of large diameter balls, the end sections of specific length of the lower ball track (58) remain free of balls (62) when the push carriage (12) is in the neutral position.

2. Load carriage according to Claim 1, characterized in that the perpendicular plane on the ball tracks (58, 60) is arranged at an angle to the vertical in such a way that the balls (62) effectively transmit the weight moment as well as the load moment.

3. Load carriage according to Claim 1 and Claim 2, characterized in that the balls (62) have a minimum diameter of 20 mm.

4. Load carriage according to Claims 1 to 3, characterized in that the ball tracks (58, 60) are incorporated into slide rails (52, 32a) which are firmly connected to the base carriage (10) and the push carriage (12).

5. Load carriage according to Claim 4, characterized in that the slide rails (52, 32a) are made of weldable steel.

6. Load carriage according to Claims 1 to 5, characterized in that the adjuster drive is an electric motor which is mounted on the base carriage (10) and connected to the push carriage by means of appropriate gears.

7. Load carriage according to Claim 6, characterized in that gears can be a spindle drive, synchronous belt drive, cogwheel drive or a chain drive.

FIG. 1

State of the art

FIG. 2

State of the art

FIG. 3

State of the art

FIG. 4

FIG. 5

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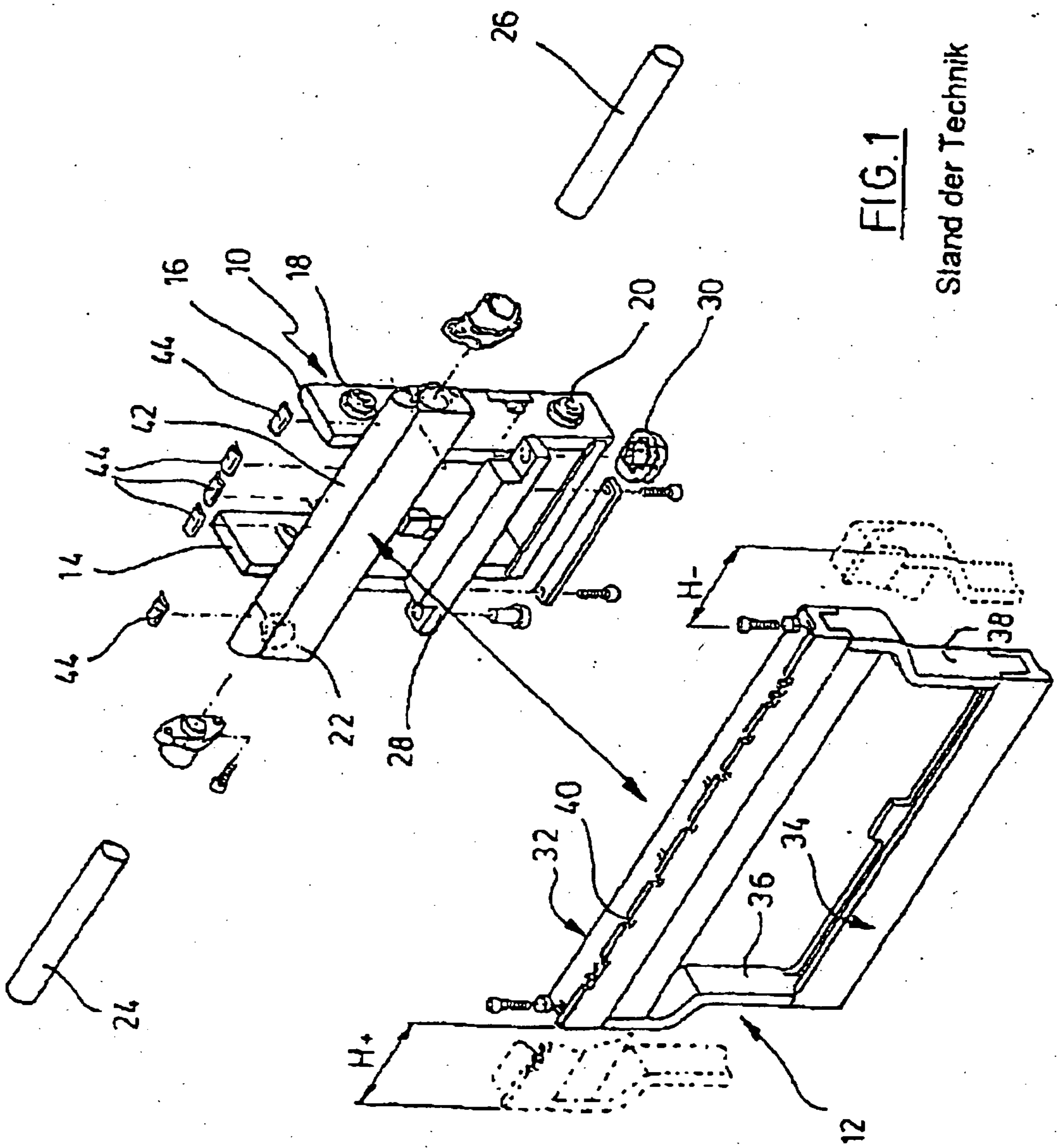

FIG.1
Stand der Technik

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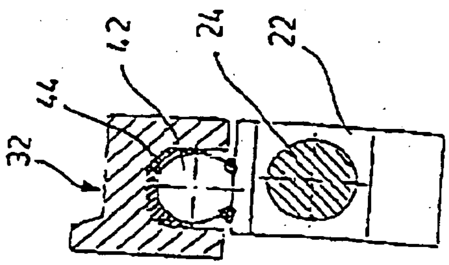

FIG.3

Stand der Technik

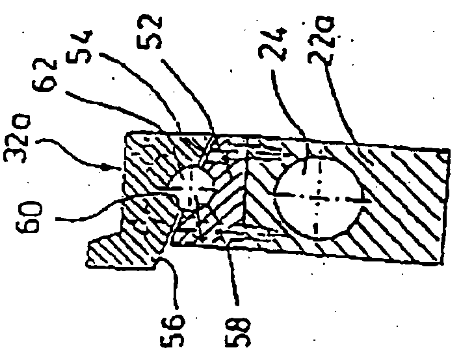

FIG.5

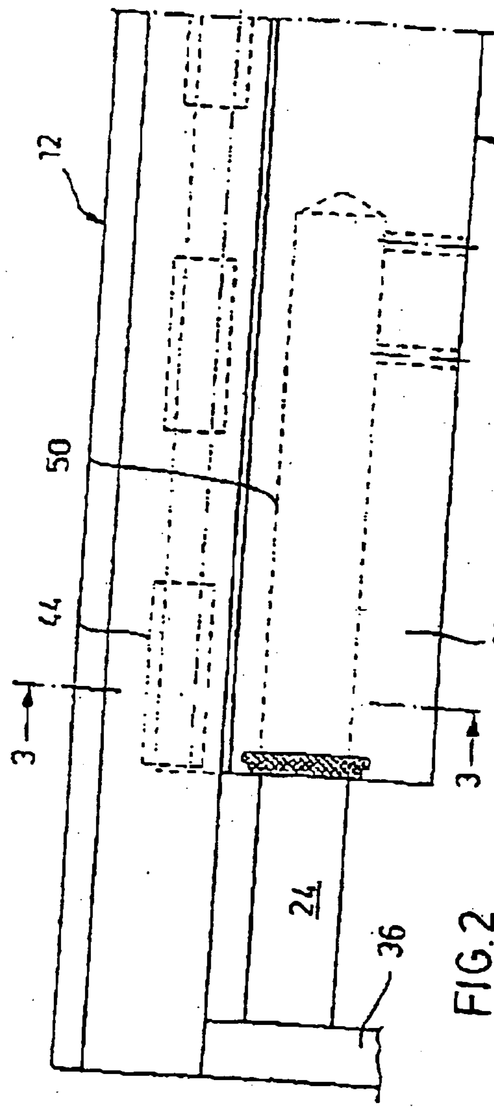

FIG.2

Stand der Technik

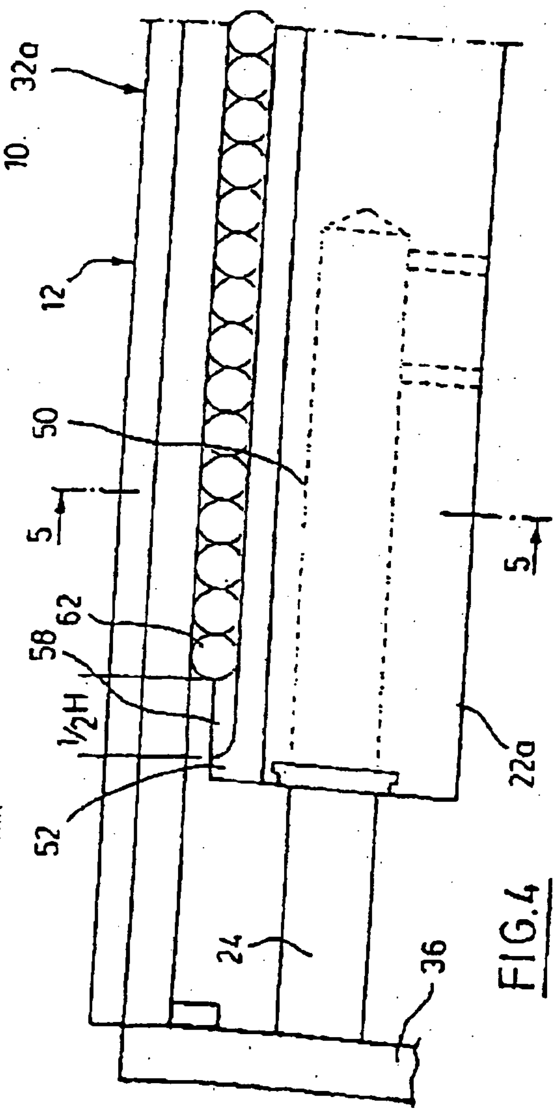

FIG.4